RFQ and water cooling

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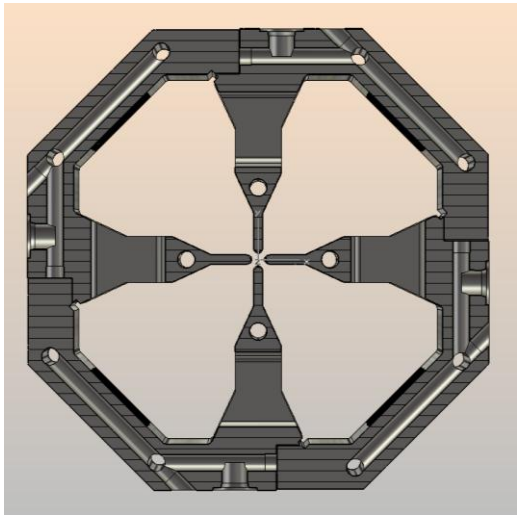
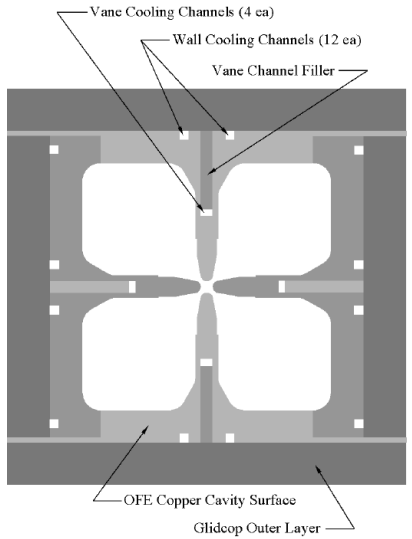
Differential water temperature tuning

HINS

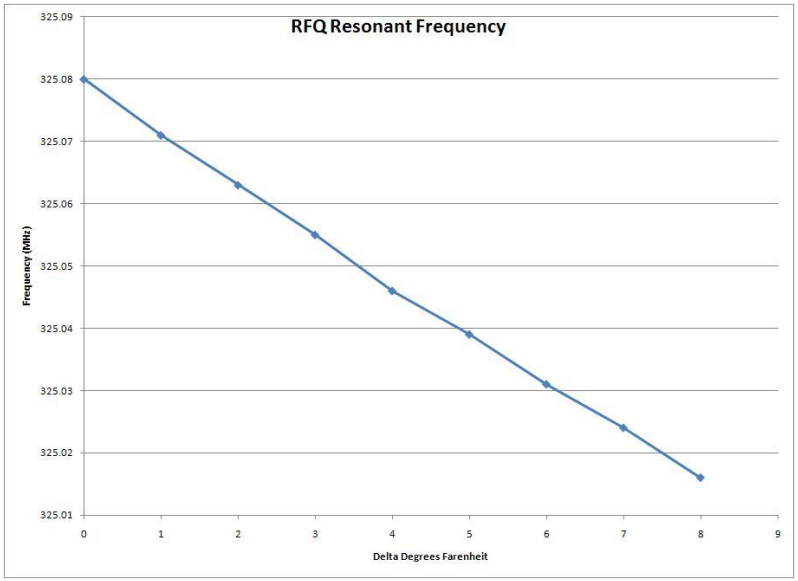


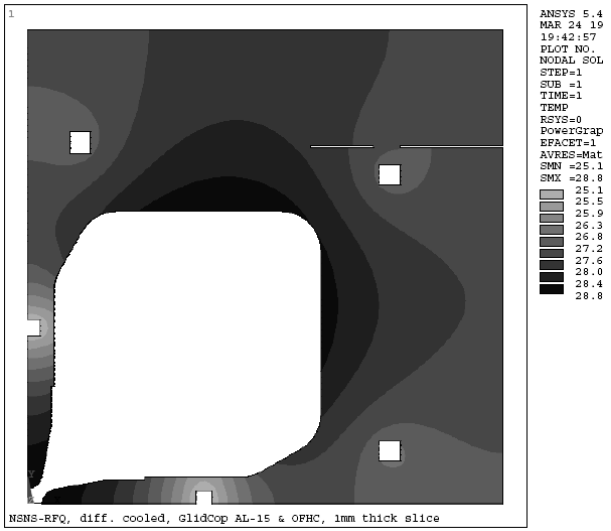
16 channels in the body

SNS



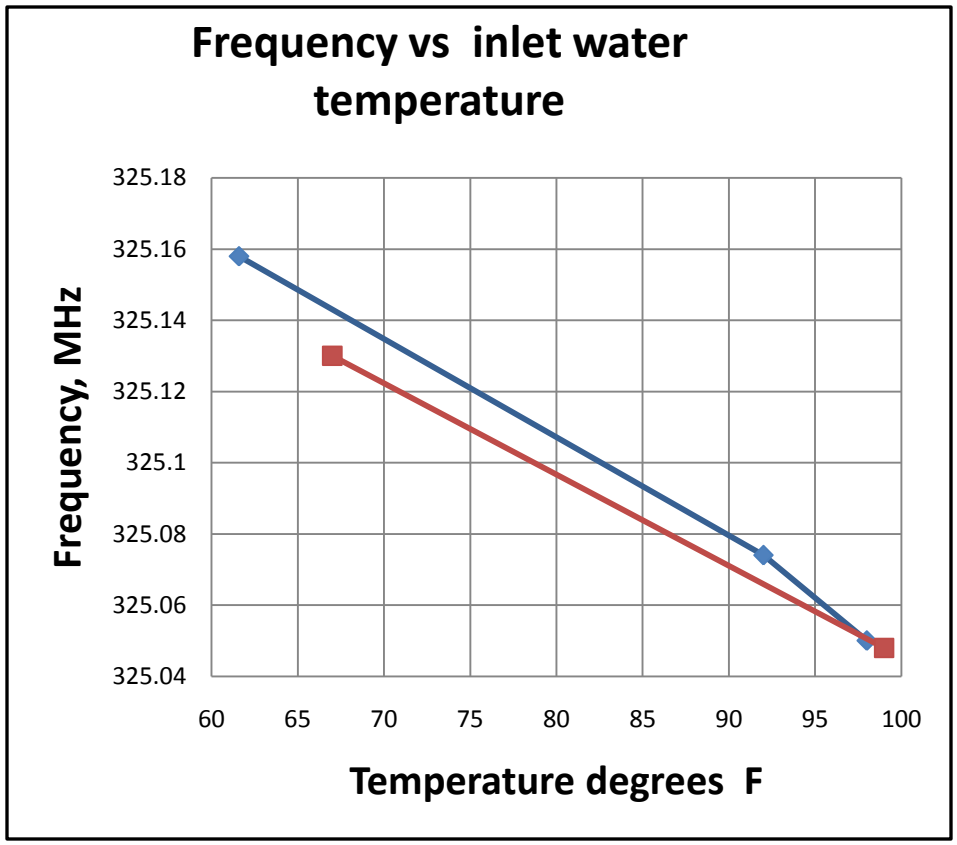
12 channels in the body





-14.5 kHz/^{o}C (-8 kHz/ ^{o}F)

-33 kHz/^{o}C



The RFQ resonant frequency was 325.158 MHz with the vane water temperature reading 61.6 degrees F. Within 90 seconds of turning on the water flow to the RFQ, the resonant frequency dropped to 325.048 MHz and then settled at 325.074 MHz with 92 degree F vane water. The resonant frequency dropped to 325.05 MHz when the water temperature reached 98 degrees F.

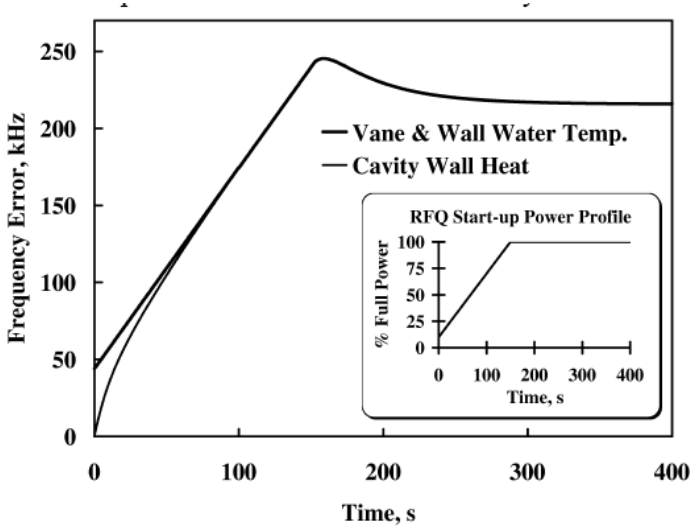
$\Delta F/\Delta T$ = -4.61 kHz/^{o}C (-5.2 theory), -2.56 kHz/^{o}F, On November 7

-2.98 kHz/ ^{o}F on November 11

For HINS

1. Return plug tuner in the original position
2. Tune RFQ to 325 MHz by common water temperature. Probably temperature will be around 100 degrees F.
3. Define how much we can tune by cooling the vanes by water . Try to increase tuning interval (different water flows in the body and vanes?).
4. Thermal and stress analyses?
5. Define frequency shift due to RF losses. I think we can do that without differential tuning.
6. Check efficiency of differential water tremperature tuning

SNS turning power on



With 18°C water in the vanes and 24°C water in the walls and no heat on the cavities, the frequency of the system is 216 kHz higher than the nominal 402.5 MHz. To correct this situation, the vane water is initially run at about 23.7°C and immediately switched to 18°C as the r.f. power is turned on. However, since the system responds faster to the wall heat than to the change in coolant temperature, a peak frequency error of ≈90 kHz occurs about 20 seconds after the r.f. turn-on, with the nominal frequency being achieved after 4 minutes. To minimize the frequency error, the r.f. is initially applied at 70% of full power and ramped up to 100% over the next 150 seconds, resulting in a maximum error of less than 15 kHz.